AGRICULTURAL Research

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U.S. Department of Agriculture

TODAY'S HEN *Page 3*

YELLOW DWARF *Page 10*

NEW ORNAMENTALS FOR THE U.S.A. *Page 8*

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Contents

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Quality Research

In the first issue of this magazine, 8 years ago, we printed a story telling the need for improving the quality of our research by paying more attention to basic work.

The article said, "It is through fundamental studies that the really big discoveries are made—the kind that break through research ceilings and lead to bigger gains on farms."

At the end of World War II, less than one-tenth of the ARS budget went for basic research. This year, however, about one-third is going for basic work, and our goal is to have one-half of the research budget devoted to these studies.

Added emphasis was placed on basic research the last few years when several pioneering laboratories were established within existing research divisions and when funds from the sale abroad of surplus farm products became available for research grants or contracts. However, most fundamental work will continue to be done in regular research divisions.

The continuous efforts in basic research have revealed important findings in recent years. For example:

*The light-sensitive pigment that triggers all plant development has been removed from plants and partly purified.

*We know more about how nutrients are transferred from the soil to the interior of plant roots.

*A step has been made toward understanding resistance, immunity, and susceptibility of plants to diseases.

*A method has been found for obtaining agglutinins that are considerably more efficient than conventional ones.

*Striking differences have been found in the composition of individual subcellular particles of oilseeds.

*A bit of the fundamental nature of pathogenic micro-organisms that cause diseases of insects has been revealed.

*Studying normal life processes of insects has provided some light on insect response to chemicals.

These findings and others have strengthened the convictions which stimulated us to increase emphasis on fundamental studies. We have been encouraged to set our sights still higher. Basic research will supply answers to many critical questions that today stand as barriers to progress.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Research has given us better ways of breeding poultry, so

TODAY'S HEN LAYS MORE EGGS

■ Improved systems of poultry breeding—developed through Federal, State, and private research—are paying big dividends in more efficient egg production.

Thirty years ago, the average hen in the United States laid 121 eggs per year; today she's laying 206 eggs. Our best flocks average 250 eggs or more per hen. As a result, 13 percent fewer hens on farms last year produced 60 percent more eggs than their ancestors did in 1930. The savings in feed, labor, and equipment represent a net gain to the egg industry.

Better balanced rations, disease and pest control, and other improved practices have contributed to this progress. But it is the flock that produces more eggs per hen than other flocks receiving *similar* feed and care that returns the highest net profit. To build flocks like this, poultry breeders must have stock capable of transmitting high egg-laying ability.

Development of more effective systems of breeding has been a goal of USDA poultry research since 1931, when ARS geneticist C. W. Knox was put in charge of poultry breeding investigations at the Agricultural Research Center, Beltsville, Md. A few years earlier at Iowa State University, Knox established the first successful inbred lines of chickens. He has been a pioneer in applying to poultry breeding the principles of hybridization, which have proved so successful in corn breeding.

Knox and his associates set up long-term experiments with White Leghorns and Rhode Island Reds to determine the best system of breeding for improved egg production, egg and body weights, viability, and other economic characters. (Previous research at Beltsville had been concerned mostly with such characters as plumage and skin colors, type of comb, and body size.)

Since the early 1930's, two standardbred flocks have been maintained as controls—a Rhode Island Red (RIR) "open" flock with new stock introduced every third year, and a White Leghorn (WL) "closed" flock (no outside stock added). Experimental breeding systems have included: (1) *inbreeding*—mating of closely related individuals within a variety; (2) *topcrossing*—inbred RIR males mated to standardbred RIR females; (3) *incrossing*—inbred RIR males mated to unrelated inbred RIR females; and (4) *incross-breeding*—inbred RIR males mated to inbred WL females and, reciprocally, inbred WL males mated to inbred RIR females.

Knox recently completed a review of the records obtained in these experiments during 1946–56. His studies showed that *incrossbreds* (progeny of inbred WL males x inbred RIR females) out-produced all the others. They averaged 260 eggs per bird annually (survivor basis) during the 10 years. *Crossbreds* (WL males x RIR females) ranked next, with an average of 247 eggs per bird per year.

Turn Page

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TODAY'S HEN LAYS MORE EGGS

(*Continued*)

The *standardbred* control flocks averaged only about 200 eggs per bird per year. Despite careful selection on the basis of both individual and progeny records, as well as improved rations, these flocks have gained only 20 eggs in average annual egg production since they were assembled 30 years ago.

Topcrossing and *incrossing* within the same variety resulted in little or no improvement and were discontinued after a few years.

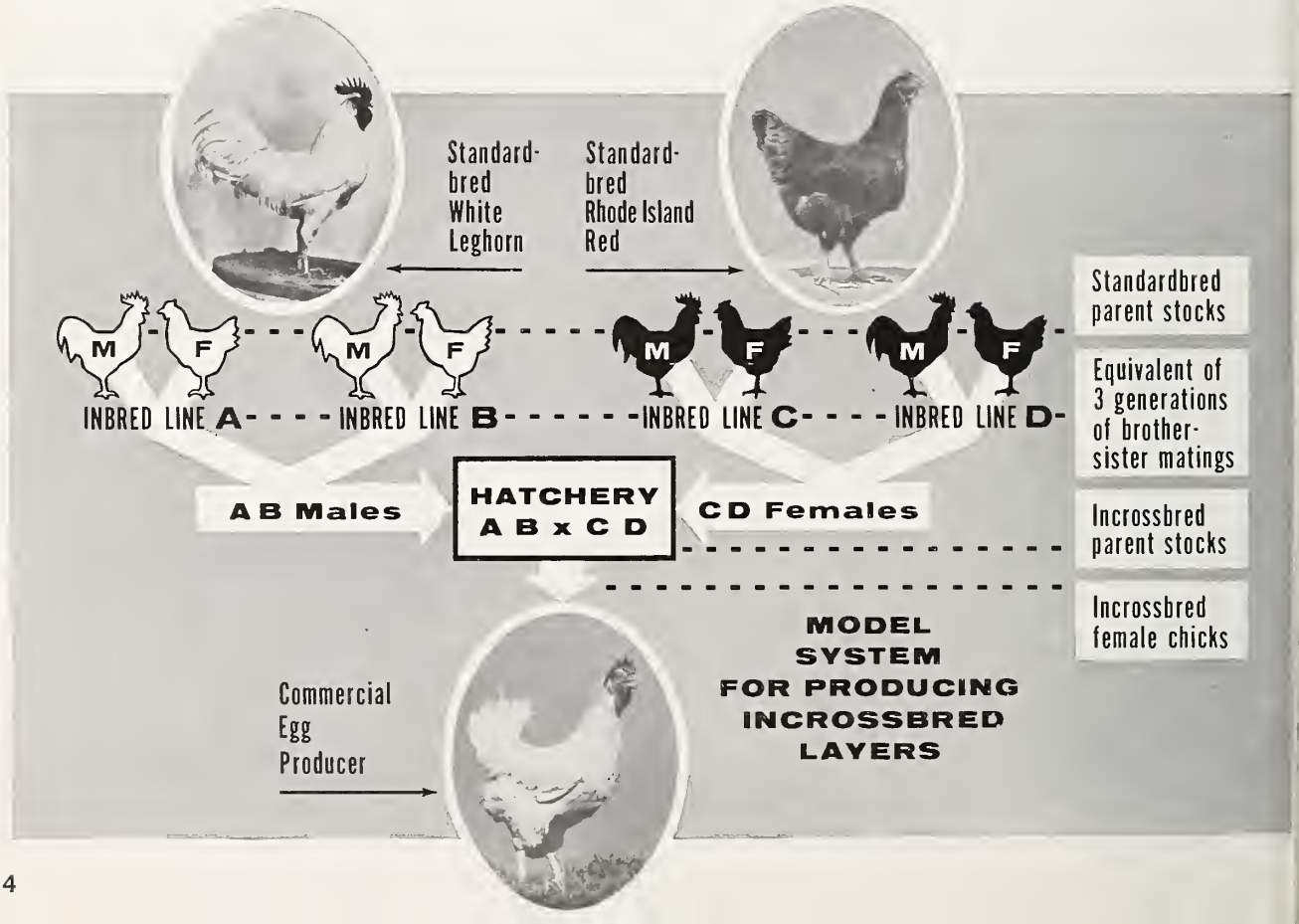
Inbreeding alone depressed egg production, but hybrid vigor in the progeny from crosses of inbreds pushed their production to top place.

The biggest gains came from using White Leghorn males in crosses of the two breeds. In previous investigations, the scientists used only RIR males—on the theory that nothing would be gained in making reciprocal crosses. Fortunately, in 1946, Knox decided to test this theory and found that progeny of WL males x RIR females averaged about 30 more eggs per bird than progeny of RIR males x WL females. This was true of both crossbreds and incrossbreds.

Knox's studies also showed that incrossbreds outranked both standardbreds and crossbreds in age at first egg, viability, body and egg weights, hatchability, and nonbroodiness. The inbreds were inferior to their standardbred parents in most of these characters, but when they were crossed their progeny regained whatever had been lost in inbreeding.

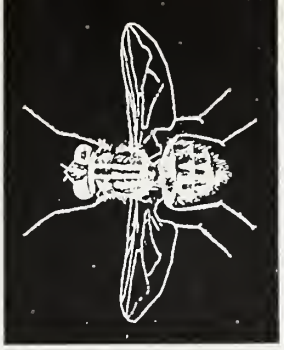
Incrossbreeding is much more complicated than straight crossbreeding. Two separate inbred lines within each of two breeds must be developed and crossed to obtain inbred parent stocks. Males of one parent line and females of the other are then mated to produce incrossbred chicks, which are raised as egg-producing stock. Commercially, breeders generally sell the inbred parent stocks to franchised hatcheries. These hatcheries produce the incrossbred chicks for sale to egg producers. Although only a few large breeders are doing incrossbreeding, they account for a substantial percentage of the chickens used to produce market eggs.

Most of our commercial egg-producing stock today includes some type of crossbreeding—either between strains, varieties, or breeds. Knox says poultrymen are becoming more aware of these higher producing stocks and are buying more of them each year. If this trend continues, he estimates that average egg production could go as high as 250 eggs per hen within the next decade. This means that by 1970 the *average* flock in the United States may produce as well as the *best* today.☆



We're attempting to find good emergency controls for this annoying pest

FACE FLY MOVES SOUTH AND WEST



Infestations of the face fly have been reduced by painting the face of cattle daily with mixtures of a bait and some insecticides.

■ Face fly, an annoying new cattle pest resembling an oversized housefly, has been found in the East from Maine to North Carolina and as far West as Nebraska.

Infestations have been extensive. For example, up to 200 flies per head were reported in New York State last summer. In mid-July, every dairy and beef herd in the central, eastern, and northern areas of that State was attacked. Neighboring Vermont reported over 100 flies per heifer in the State university herd. New Jersey farms had as many as 75 flies per animal.

The insect clings to the face of cattle and flits in and out of their eyes, causing profuse tearing. It feeds on the mucous of eyes, nose, and mouth, and blood oozing out of open cuts. Because they are so busy trying to get rid of the flies, animals neglect to graze.

Adult fly winters in protected places

Infestations begin with warm weather and increase until fall. Cool weather causes the face fly to hibernate. This insect spends the winter as an adult fly in barns, unheated attics, and other protected places.

European and Asian cattle have been bothered many years by the face fly, but it wasn't found in North America until 1952 when it was discovered in Nova Scotia (AGR. RES., October 1959, p. 16). In 1953 the first occurrence of face fly in the United States was reported on Long Island, N.Y. The pest was recognized as a serious nuisance last year, when it was found in large numbers in Illinois, Indiana, New York, New Jersey, Ohio, Pennsylvania, and parts of Virginia.

ARS entomologist J. H. Fales has been trying to provide emergency control of face fly with baits and insecticides. So far he has found nothing with which he is completely satisfied. Baits containing malathion, DDVP, or Dipterex were tested with some favorable results. Apparently, sugar is more attractive than an animal and flies will leave eyes, nose, and mouth to feed on poisoned sugar bait on another part of the body.

Field tests of the bait-poison combinations were conducted last summer in the Maryland area. On one dairy farm, the average count of face flies per head went from 10 to 3 during daily applications for 3 weeks of a bait containing malathion. No reduction occurred in a similar test where applications were not daily.

USDA has approved DDVP, an organic phosphate insecticide, for use in a face fly bait. If applied daily as recommended by the manufacturer, this poison presents *no* hazard to cattle and *does not* contaminate milk or meat. In tests by the Illinois Agricultural Experiment Station, the suggested mixture of DDVP, corn syrup, and water was effective during the summer of 1959.

Other commercial insecticides have been tried too. They were successful in greatly reducing a light infestation at the Agricultural Research Center, Beltsville, Md., but failed to clear up heavier attacks on nearby farms. Although some insecticides have partially reduced large face fly populations, it takes one or more applications per day to keep down the number of flies. Further work is being done to determine how frequently the applications are necessary.

Face flies seem to attack male and female cattle indiscriminately. At Beltsville, the flies haven't been seen attacking sheep, goats, or swine with cattle. But the pests were found abundantly on horses.

This insect, *Musca autumnalis Deg.*, looks like the housefly, another species of the same genus. The face fly is somewhat larger and darker in color. The male has an orange-yellow abdomen, with a dark stripe down the middle, and eyes that almost meet.

Female fly, not the male, pesters cattle

Animals are annoyed only by the female face fly, however, and they are harder than the male face fly to distinguish from houseflies. Male face flies are content with a diet of nectar and pollen, but the females need animal secretions—apparently for producing eggs. These are laid in fresh manure where larvae develop. Pupation presumably occurs in surrounding soil.

In laboratory tests at Beltsville, attempts to rear larvae on media other than fresh manure were unsuccessful. Biology of the fly is being studied and different methods of rearing tried in attempts to produce this insect in the laboratory so research on insecticides can continue throughout the winter.☆

Farm real estate taxes at new high

National survey shows that State and local levies last year increased 8 percent over those a year earlier

■ U.S. farmers this year paid the biggest farm real estate tax bill on record, a USDA study shows.

These State and local taxes, levied in 1959 and payable for the most part in 1960, amounted to $1.2 billion—an increase of 8 percent over 1958 levies and the sharpest annual rise since 1948.

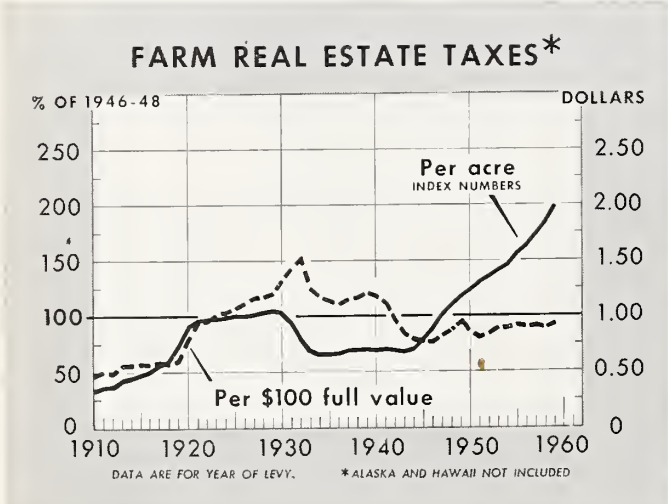
Tax per acre of farmland rose from an average of $1.03 in 1958 to $1.11 in 1959. The study, by ARS farm economist F. D. Stocker and associates, was based on an annual nationwide survey of more than 27,000 sample farms and involving the cooperation of 3,000 local tax officials.

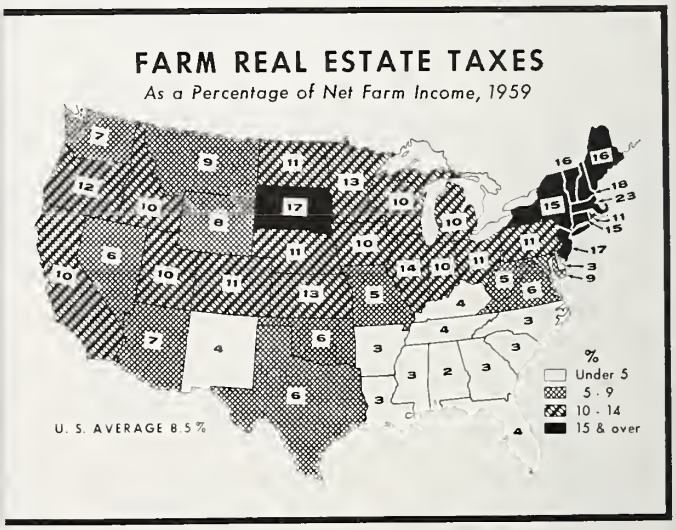
Stocker says taxes were higher in 48 States (estimates for Alaska and Hawaii were not available), but increases varied greatly. West Virginia reported the biggest increase—20.1 percent, and Virginia the smallest—1.6 percent. In 13 States, taxes went up more than 10 percent, and in 22 States between 5 and 10 percent. Increases of less than 5 percent were reported in 10 States.

Taxes per acre of farmland also varied from $9.15 in New Jersey to $0.10 in New Mexico. Farmers in 14 States paid more than $2 per acre, in 10 States between $1 and $2, and in 24 States less than $1.

These variations in total and per-acre tax levies reflect differences in value of farmland and improvements and in tax systems. In the Northeast, for example, where taxes per acre averaged highest, farms are generally small and intensively operated, with a high value per acre and a large average investment in buildings and other improvements. In addition, the property tax in this area is a relatively important source of State-local revenue.

In the Mountain States, where





Taxes absorbed 8.5 percent of net income in 1959, compared with 6.8 percent of 1958 income. Tax per $100 of full value was highest since 1949. Three-fourths of the tax payments was spent on financing schools and highways, and welfare.

taxes per acre are low, much farm acreage is low-value grazing land, with relatively few improvements.

A comparison of taxes in the different type-of-farming areas showed they were highest in fruit, truck, mixed-farming, and dairy areas. Average tax per acre was more than 3 times the national average. They were lowest in the range-livestock and cotton-farming areas, where the per-acre tax averaged less than half that for the country as a whole.

Tax-value relationship changed

In recent years, the uptrend in farm taxes has been closely matched by a rise in the market values of farm real estate, and taxes have remained around $0.90 per $100 of full value. Last year, however, land values rose only about half as much as in the preceding 3 years. As a result, the higher tax levies pushed the tax-to-value relationships from $0.89 per $100 in 1958 to $0.93 in 1959—the highest tax per $100 of full value since 1949.

The continued rise in farm real estate tax levies is a direct result of the expanding revenue needs of local governments. In 1957, for example, less than 2 percent of the total general property tax in the United States was collected by State governments. The other 98 percent, totaling $17 billion, went for schools, highways, welfare, and other local activities.☆

BOOSTING A DECLINING APPLE INDUSTRY

■ Restoration of commercial apple production in the Southeast is the goal of new research initiated by USDA and the Georgia Agricultural Experiment Station.

Thirty years ago, Georgia and other Southeastern States were important sources of early-season eating apples. Production has been steadily declining, however, and today only a few orchards in the area are producing apples for sale.

This decline was caused partly by frequent attacks of apple blackrot and fireblight that cut yields and quality of fruit. And late spring frosts at times destroyed the entire apple crop.

Rather than continue risking financial loss because of the hazards involved, most of the commercial growers shifted to other crops. The result is a gap in the fresh apple market, as well as loss of a once profitable enterprise in the Southeast.

Scientists and growers believe these production difficulties can be ended—and the industry restored—by new varieties tailored to the growing conditions. So long-term apple-breeding research was started last spring at the Georgia Mountain Experiment Station, Blairsville, under the leadership of ARS horticulturist J. B. Hardigree.

Specific objective is varieties of red apples with good culinary and dessert qualities that will stand up through normal handling and shipping. The varieties must mature early for the fresh-apple market, and blossom late to reduce the hazard from spring frosts.

Effective fungicides are available for controlling blackrot, but a search will be made for breeding stocks with resistance to all apple rots, fireblight, and other diseases in the Southeast.

Hardigree says the job of assembling standard varieties for parent stocks is progressing well. Some 60 different varieties were planted at Blairsville last spring, and probably an equal number will be added next spring. These foundation plantings, of course, will not begin fruiting for 5 to 8 years.

Meantime, through informal cooperation with the Virginia Agricultural Experiment Station, Hardigree is making variety crosses in orchards at Blacksburg, Va., where an outstanding collection of standard apple varieties and selections from other experiment stations has been maintained for many years. Seed from the first of these crosses will be planted at Blairsville next spring, thus giving the scientists a head-start of several years in the actual breeding and selection of improved varieties.☆

The Jardin Exotique of Monaco yielded some 300 ornamental cacti and other succulents for our hot, dry Southwest.

Some 2,800 different kinds of plants have been introduced, and more are coming

New ornamentals

A wealth of new ornamentals for American homes and gardens, parks, and institutional and industrial grounds is the way ARS botanist F. G. Meyer describes the plants collected during his recent exploration in southern Europe, England, and Scotland.

The 9-month USDA expedition—sponsored by Longwood Foundation, Kennett Square, Pa.—included visits to some 80 public and private gardens containing ornamentals introduced from the world during the last 400 years. Meyer also made a brief excursion into the hinterlands of southern Spain and Portugal to collect wild species for use as germ plasm by U.S. plant breeders.

In all, he brought back about 2,800 different kinds of ornamental plants. Some are new, others grew here at one time, and others are varied or more beautiful forms of familiar species.

The collection consists primarily of named varieties (cultivars) adapted to out-of-doors growing in the southern half of the United States and for use as houseplants anywhere. (Evergreens and other ornamentals adapted

Fat, 12-inch rosettes of Mexican Echeveria gibbiflora *look like giant lettuce heads, make excellent rock garden plants.*

Wild daffodil (Angel's tears) from foothills of Serra da Estrella, Portugal, has creamy-white flower.

for the U.S.A.

Meyer assembles plant cuttings he has prepared for shipment to USDA's Glenn Dale station.

o our northern areas have been collected during a similar exploration in northern continental Europe. Meyer is now compiling a list of these later introductions.)

Types of plants range from tiny African stone plants to giant sycamore trees . . . from rare species of narcissus growing in the world's oldest botanic garden at Pisa, Italy, to modern hybrid gazanias (with many-color blossoms resembling sunflowers) found in the Royal Horticultural Society garden in Wisley, England. The wild plant collection includes brooms, crocuses, carnations, pinks, oleanders, snapdragons, and daffodils.

The introductions (cuttings and seed) have passed quarantine requirements at USDA's Plant Introduction Station, Glenn Dale, Md., and have been distributed to: (1) government arboretums, where specimens will be grown as authentic reference plant materials; (2) regional plant introduction stations, where viable stock will be maintained for breeding; and (3) breeders who cooperate with ARS in propagating introduced ornamental plants for our nursery and florist industries.

Interest in growing ornamentals, Meyer says, is at an all-time high. Retail sales of nursery stock—estimated at $875 million in 1960—have more than doubled in the last 10 years. The total horticultural specialties industry, which includes both nursery and florist stocks, is currently valued at about $2½ billion.

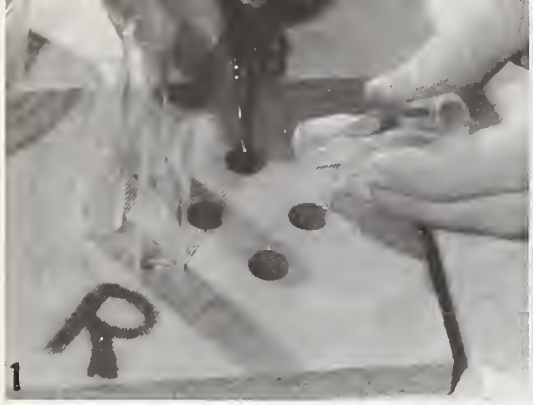
There is increasing demand for different sizes and kinds of plants than those traditionally grown in this country. Many foundation plantings, developed for the 2- and 3-story houses of a generation ago, are too large for effective use with today's 1-story, rambler-style houses. Home owners want small, slow-growing plants that will add attractiveness without obscuring light and view. More suitable plants are also needed for use along Federal-State highways under construction, as well as for landscaping industrial sites.

To help meet these needs, USDA, in cooperation with State agricultural experiment stations and industry, is intensifying efforts to introduce and develop new and improved types and varieties of ornamental plants.☆

Mediterranean hackberry tree has smooth white bark, grows 100 feet high, resists drouth.

Chinese holly has dull-green leaves, reddish stems, showy red fruit.

Hardy, clump-forming bamboo, new to U.S., stays confined, is fine hedge.



Aphids are placed in feeding chambers topped with membrane on end of tube.

After feeding through membranes, aphids are brushed onto plants.

Aphids then feed on test plants, later checked for virus growth.

WE'RE ADVANCING ON YELLOW DWARF

It's important to use more than one aphid species when testing plant selections for resistance to BYDV

Fine glass needles can also be used to inject virus solution directly into the aphids.

Last summer, barley yellow dwarf virus caused spring oat losses of 10 to 50 percent in infected fields in the Northeast. Infections were low in the north-central and northwestern oat-producing States, where losses ranged up to more than one-third of the crop in 1959.

Most heavily infected this year were Pennsylvania, New York, New Jersey, and Maryland. Losing most last year were Missouri, Illinois, Indiana, Kansas, Oregon, and Iowa.

Federal-State research to halt spread of the virus has been intensified. Breeding of oats with more tolerance to the virus appears to be the only practical way to get control.

Three different strains of barley yellow dwarf virus—which causes a disease of oats, barley, and other grains—have been identified by a USDA-State scientist.

The strains are differentiated from each other by the fact that each is usually carried by a different aphid species. Aphids are the only means by which barley yellow dwarf virus (BYDV) is transmitted to plants.

Existence of three strains specific to certain aphid vectors shows the importance of testing plant selections for presence of BYDV with more than one aphid species.

ARS plant pathologist W. F. Rochow identified the strains in research with the Cornell University Agricultural Experiment Station.

Rochow first identified different strains of BYDV in diseased plants from the New York area. Individual leaves from the plants were divided into two sections. English grain aphids and apple grain aphids were placed on the separate sections, then transferred to test plants. The English grain aphid was able to transmit the virus to test plants only from certain leaves; the apple grain aphid, from certain other leaves.

Plants from 13 States used

In using diseased plant collections from 13 States, a third strain of BYDV, transmitted only by the corn leaf aphid, was identified.

Vector specificity of the strains is not absolute because in some cases one aphid species may transmit the strain usually carried by another. Also, in some areas of the country, there appears to be less differentiation of the virus into vector-specific strains. Researchers in Washington, for example, found that most BYDV in that area is carried indiscriminately by English grain and apple grain aphids. The virus is transmitted by three additional aphid species—the greenbug, rose grass aphid, and blue grass aphid.

Efforts are now being made to isolate the virus from diseased plants to

determine its chemical properties and the basis for differences among strains, and to study its size and shape by electron microscopy.

To get the virus out of diseased plants, so that it may be purified, juice is extracted from the plants and subjected to a succession of refinements. Since the virus can't be seen or its presence determined by other methods used with plant viruses, transmission of the virus by aphids to test plants is the only way to ensure that it is present in the extracts. (Infectivity tests of some plant viruses may be made by rubbing an extract and an abrasive on test plant leaves.)

Natural feeding simulated

Rochow has developed a technique that obtains high transmission of one strain of BYDV by aphids from liquid extracts to test plants. The method simulates natural feeding conditions for the aphids, which normally feed on the underside of leaves.

Liquid virus preparations, made of clarified plant juice and a sugar solution, are placed in tubes, which are sealed by a membrane. The tubes are suspended with the membrane side down, and aphids which have been starved for a few hours feed upside down through the membrane. The aphids are allowed to feed 16 to 18 hours and are then transferred to test plants, where they feed 3 days. Symptoms of disease in test plants show up within 2 weeks.

Rochow's work marks the first time membrane-feeding has been successfully used with aphids. (It has previously been used with leafhoppers transmitting other viruses.)

Another method of transmitting BYDV to aphids—by needle injection—was worked out by W. C. Mueller, graduate student at Cornell University, Rochow, and plant pathologist A. F. Ross of the Cornell station.

Nonfeeders receive injection

Virus preparations are made up from plant juice extracts, haemolymph (the body fluid of insects which corresponds to blood and lymph in higher animals), or haemolymph extracts. Fine glass needles are used to inject the preparations into the aphids, so virus preparations which aphids won't feed on through membranes may be used.

Both infection techniques have been used to confirm the vector specificity of the virus strains.☆

IMPROVEMENT IN FOAM-MAT DRYING

A faster, more efficient technique in foam-mat drying—part of the experimental process for making instant tomato juice—has been developed.

The new technique, crater drying, represents an important step toward commercial use of the process.

The crater technique uses perforated metal trays instead of a plastic-coated belt to dry tomato juice foam. The dry foam is crushed into a powder that can be reconstituted with water (Agr. Res., December 1959, p. 8).

Blasts of air rush through the perforations at 150 feet per second, piercing the foam, which has been spread on the trays, and causing it to rise in craters. These expose a greater foam surface to the drying air. Thus, the foam can be dried in 12 minutes instead of the 40 minutes required with the earlier technique.

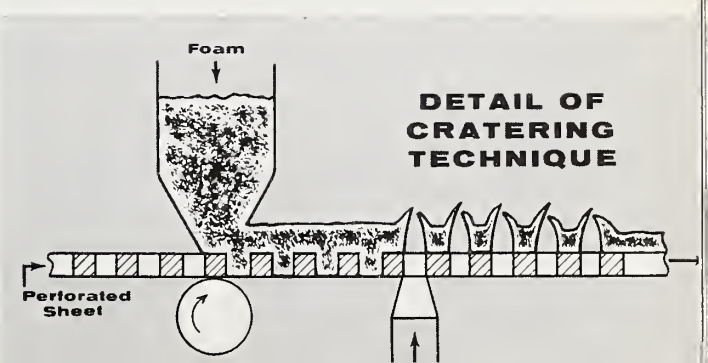
The foam is made by whipping tomato juice concentrate and a small proportion of stabilizer (such as solubilized soya protein or glyceryl monostearate).

Foam-mat drying and the crater technique were developed at USDA's Western utilization division laboratory, Albany, Calif., by ARS research engineers A. I. Morgan, Jr., R. P. Graham, and L. F. Ginnette.

Using the new method, foam is easily removed from the trays. These need no washing, are more durable than the belt, and make continuous movement through an air stream more economical. Automatic loading and unloading of trays are possible.

There are two stages in the drying operation—one using air at about 200° F. and the other at 130°. In the first stage, air moves at 5 feet per second in the same direction as the trays. Then air moves in the opposite direction at 2 feet per second. About half a pound of powder can be produced per square foot each hour in this way.

In tests of the original foam-mat technique, powders of good initial flavor and color were made from prune whip, potato, lemonade; and juices of apricot, pineapple, apple, grape, and orange; and other liquid foods. Studies are now underway to see how these materials can be crater dried to produce better products.☆



Spinach lines that offer advantages

All-female plants, resistant to mosaic and two races of blue mold, end need to rogue out unwanted males

■ We're developing new spinach lines that will cut hybrid seed production costs—and are resistant to mosaic and two races of blue mold.

Seed of the new lines produces *only* female plants, thus eliminating the need for roguing (removing unwanted male plants from the seed-producing line), the major cost item in hybrid seed production.

Further selection and testing will be done before the lines are available, but it's expected that a few will be ready soon. Some lines underwent commercial trials last fall. Testing is done at USDA's Agricultural Research Center, Beltsville, Md., and elsewhere in cooperation with State and private agencies.

ARS plant pathologist R. E. Webb developed the new lines for use as the female parent of hybrids.

Spinach is usually dioecious. Male (pollen-producing) flowers are borne on one plant and female (seed-producing) flowers on a separate plant. Seed normally produces half male and half female plants. There's no way to tell which type of flower a plant will bear until flowering age, so many roguing operations are required in hybrid seed production.

First of types with resistance

The all-female producing lines arose out of research to incorporate resistance to blue mold in savoy and semisavoy spinaches, the main ones grown for fresh and frozen uses in the U.S. The new lines will be the first savoy and semisavoy spinaches for fall production with immunity to the two races of blue mold, as well as mosaic resistance. Blue mold is the main disease of spinach in the major producing areas.

Work is also in progress to incorporate resistance to other spinach diseases, including white rust, in the all-female lines.

Because spinach has separate male and female plants, incorporating disease resistance in it is twice as complicated as usual. For example, to test the ability of a spinach line to pass on blue-mold resistance to its progeny, a female plant was crossed with a susceptible male, and the progeny screened for resistance. A similar procedure was required for the male plant of the line, to make sure the line contained only genes conferring resistance.

Webb had learned of research in which spinach, grown under various conditions, in some cases bore seed which produced only plants bearing female flowers. In his experiments, in certain lines which normally produce male and female flowered plants, female flowered plants were isolated that developed some male flowers with pollen and produced seed. The seed produced only plants that bore

Typical male spinach plant, bearing pollen, is eliminated from new lines, ending roguing in hybrid seed production.

After pollination, female plant of standard variety bears seed which grows into either *male or female plants.*

Plants of new lines, with both male and female flower parts, self-pollinate; seed produces female-flowered plants only.

female flowers. Further tests showed that the all-female characteristic was genetically controlled.

This discovery opened the possibility of using the characteristic to simplify not only the breeding of disease-resistant spinach but also the production of hybrid seed.

In developing blue-mold-resistant spinach, use of all-female lines meant that only one progeny set had to be screened instead of two. And, of course, in hybrid seed production, the need for roguing out males would be eliminated.

Some hybrids get second test

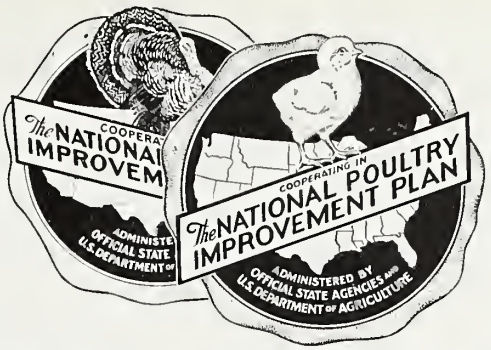
Selection and testing of the all-female lines have been done 3 years. Hybrids from some were being tested the second time this year.

Further selection will be made to make sure the new lines breed true for the all-female characteristic and to eliminate plants bearing hermaphroditic flowers. (These are plants which bear both sexes in one flower and are therefore unusable in hybrid seed production.)

Selfing doesn't reduce vigor

The all-female plants normally develop hermaphroditic flowers (at the top of the stem) toward the end of the growing season. This won't interfere with hybrid seed production, because seeds borne at the top of the stem are small and immature at harvest, and can easily be separated from the hybrid seed.

Research shows that selfing the female plants doesn't reduce the vigor of a line. The new lines have slightly lower seed yields than is normal, but savings in roguing costs will more than make up this loss.☆



NPIP and NTIP Changes in Effect

■ Changes in the National Poultry Improvement Plan and National Turkey Improvement Plan—adopted at the 1960 biennial conference—became effective in October, after publication in the Federal Register.

USDA poultry husbandman P. B. Zumbro, coordinator of the plans, says the aim is to provide greater conformity with advances in poultry breeding and disease control.

Under the new provisions, breeders may elect to reduce to 7 weeks or less the growing period of broilers entered in random sample tests. Because of better breeding, feeding, and management, many birds at 8 weeks are larger than desired by today's consumers.

On-the-farm performance testing is eliminated from the NPIP. Farm tests have become unpopular, because central tests, using uniform growing and management practices, provide more accurate data for comparing different stocks.

To be classified as U.S. Performance Tested Parent Stock, a stock must be represented in random sample tests by entries whose average performance exceeds that of all entries in all tests. This change sets a higher standard for U.S. Performance Tested parent stocks for egg and meat production.

U.S. Pullorum-Typhoid Passed classification is eliminated from the NTIP, since most of the turkey hatcheries in the United States now qualify as U.S. Pullorum-Typhoid Clean.

In addition to specific changes in regulations, the delegates adopted, with slight modification, the hatchery and flock sanitation procedures recommended by a special work conference established at the request of delegates at the 1958 biennial meeting.

The 1960 delegates voted also to establish committees to consider control programs for CRD (chronic respiratory disease) complex and epidemic tremors (encephalomyelitis) in chickens and infectious sinusitis in turkeys.

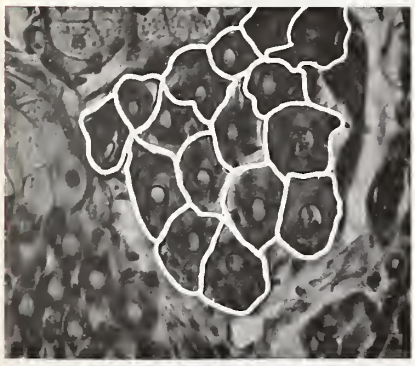
Strengthened research was proposed in several fields—including air sampling, hatchery construction, fumigation of eggs in containers and incubators, disposal of hatchery waste, temperature and humidity in fumigation, Salmonella contamination of feed, and disinfection of hatchery equipment.

NPIP and NTIP are administered by the Animal Husbandry Research Division of ARS. Participation is voluntary and includes about three-fourths of the Nation's hatchery capacity.☆

They go together:

PROPER NUTRITION and THRIVING MINKS

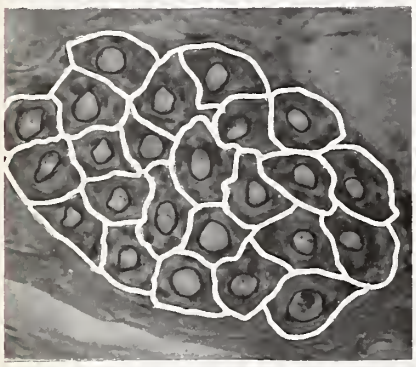
Densest fur was produced by test animals receiving the best diet



JULY

GROUP I
GOOD DIET

The sample taken in July has 16 hairs (in cross section) in the follicle group. In the sample taken in November, there are 24 follicles. Denser growth of hair occurred in minks receiving a better diet than their litter mates in the experiment on nutrition.

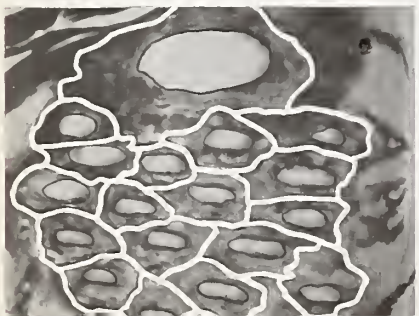


NOVEMBER

JULY

GROUP II
POOR DIET

In the skin sample taken in July, 11 hairs (in cross section) comprise the follicle group. In the other sample, taken in November, one guard hair follicle and 17 underfur follicles are in grouping.



NOVEMBER

■ Proper nutrition is especially important if minks are to have healthy bodies and thick coats, according to researchers at Beltsville, Md., and Ithaca, N.Y.

Two dozen young minks, all litter mates of average size and quality, lived their first 42 days with their mothers. (The diet fed to the mothers was developed at USDA's Fur Animal Experiment Station, Ithaca.) On the 43d day, half the animals were switched to a poorer diet and the others stayed on the station diet.

Six weeks later, the pelts were nearly twice as dense in the group getting the better diet (Group I) as those in the second group. Group I maintained this lead throughout the test. Since body growth is also affected by diet, the animals with sparser hair were lighter in weight than their better-fed litter mates.

Fur density was determined by measuring the ratio of underfur to guard hairs. Guard hairs are long, straight, fairly thick hairs, each surrounded by a cluster of shorter, finer, curlier hairs—the underfur.

At birth, minks have about five times as many underfur hairs as guard hairs. This ratio increases as the animal grows. In Group I, the underfur-guard hair ratio reached 29:1 when the animals were about 7 months old. Highest ratio recorded for Group II was 19:1.

Biweekly biopsies were made on the experimental animals to measure their hair densities. Using a local anesthetic, the workers removed small skin samples from the mink's backs. In addition, some animals were killed and their entire pelts analyzed. The animals were kept and their pelts sampled at Ithaca by Cornell University animal nutritionist R. G. Warner and C. F. Bassett, superintendent of the Fur Animal Experiment Station. The samples were sent to Beltsville, where ARS microanalyst Ethel H. Dolnick examined them.

The well-fed animals were on a diet similar to that used by commercial mink growers. Seventy-eight percent of the diet for Group I was made up of equal parts of horsemeat, lungs, tripe, and chicken waste. The rest of the feed was liver (5 percent), fat (2 percent), and cereal (15 percent). Group II was fed 40 percent of the same diet plus uncooked ground wheat (48 percent) and choice white grease (12 percent).

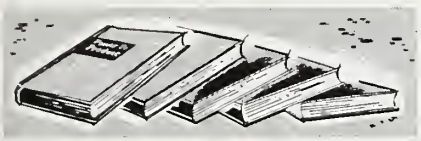
In later studies, the researchers will try switching the diets of some animals midway through the test period. They want to know if an animal on a deficient diet will develop a thick coat if his ration is changed. Similarly, they want to see if a coat will become thin if meat is replaced by a starchy grain.

More than presence or absence of meat accounts for the differences in mink growth. They are particular about their food and unpalatability of the low-meat diet may have caused them to eat less than usual.☆

Yearbook for 1960 is available

How the mechanical revolution on the farm has brought a better life to Americans in a few short years is described in *Power To Produce*, 1960 Yearbook of Agriculture.

Power To Produce tells of the dramatic change from horse-drawn operations to the marvels of push-button automation. The yearbook,



published by USDA, is designed for everyone interested in the benefits and problems that farm technology has brought to this country.

Topics of its 60 chapters, 96 pages of photos, and 480 pages include the development of tractors, electricity, communications, power on the land, harvesting methods, developments in handling livestock, mechanization of marketing, farm buildings, efficiency of labor, the effects of power, and power in the future. *Power to Produce* was written by 90 engineers and technicians in USDA and industry.

Yearbooks are sold through the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for $2.25 each.

Indiana qualifies in campaign

Indiana, recently declared a modified-certified brucellosis area, joins 25 other States qualifying for this important milestone in the USDA-State campaign to eradicate the costly disease of cattle.

Now certified are 2,019 counties—or 65 percent of the 3,152 counties in the United States, plus Puerto Rico and the Virgin Islands.

Earlier this year, New Hampshire became the first State to be declared brucellosis-free in the eradication effort. In 6 other States, 22 counties are so designated.

Indiana joins these modified-certified States: North Carolina, Maine, Washington, Wisconsin, Delaware, Minnesota, Connecticut, Vermont, Rhode Island, Pennsylvania, Utah, New Jersey, New Mexico, Michigan, Massachusetts, Nevada, Maryland, Arizona, Oregon, Tennessee, West Virginia, New York, Georgia, and Idaho.

Modified-certified areas have brucellosis infections in not more than 1 percent of the cattle nor in more than 5 percent of the herds.

Improves cane, lowers costs

Production of higher quality sugarcane and reduction of harvesting and milling costs appear possible by removing 6 to 8 inches more than usual of the cane tops during mechanical harvesting operations.

In experiments at Houma, La., by USDA plant physiologist R. E. Coleman, removal of a greater length of cane top increased the value of harvested sugarcane nearly $1 a ton and offset the loss of sugar in the tops. The amount of green trash—leaves and other plant material—on the sugarcane was greatly reduced.

Trash brings impurities into sugarcane juice, lowers the percentage of juice extracted, and reduces recovery of sugar. Harvesting trash adds to processing and milling costs.

Mechanically harvested sugarcane is generally cut so that the average stalk is topped at the highest mature joint. While this removes 2 feet or more of leaf-and-stem trash, it does not get all green and immature growth. And green trash doesn't burn well when harvested cane in heaprows is flame-cleaned in fields.

Since mechanical harvesting of sugarcane began, trash and inadequate topping have caused large losses of sugar, especially when harvesting was necessary during rainy weather. Wet trash considerably decreases the purity of juice and recovery of sugar. The ARS scientist attributes this loss to dilution of the juice by absorbed water.

Treatment shrinkproofs wool

A new chemical treatment for applying a shrinkproofing coating to wool fabrics, making them safely washable in machines, has been discovered by USDA scientists.

Treated fabrics retain wool's soft texture yet wash repeatedly without shrinking and dry without wrinkling. Successfully shrinkproofed in the laboratory were suitings, knitted wear, blankets, and other wool goods. After enduring machine washings, dry cleaning, and wear stress, the garments retained dimensions, colors, and resilience.

Wool fibers are covered with an extremely durable, ultrathin coating of a polyamide—chemically similar to a type of nylon. (Commercial equipment should be suitable for the application.) The method may find

use also for coating materials such as other natural fibers and paper.

The treatment can be combined with a recently announced ethanolamine method for putting permanent creases and pleats in wool fabrics

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(AGR. RES., October 1960, p. 16). It differs, however, from a shrinkproofing treatment previously reported (AGR. RES., July 1957, p. 6). That treatment uses blends of polyamide and epoxy resins—complex chemicals obtained in part from products such as animal and vegetable fats.

This new way of shrinkproofing was developed at the Western utilization division, Albany, Calif., by ARS chemists W. L. Wasley, R. E. Whitfield, L. A. Miller, and W. Fong.

For treating, wool fabric is immersed in a dilute solution of a diamine, drawn through a dilute solution of diacid chloride, rinsed in water, and dried.

Nutrition research need cited

"I am convinced that in research lies our greatest hope for eliminating hunger throughout the world," ARS Administrator B. T. Shaw told the recent Fifth International Congress on Nutrition in Washington, D.C.

"We are entering the golden era of biological science," he added. Even now "it is technically feasible to meet and exceed present world food needs without adding new cropland."

About 2,200 research scientists from 69 countries attended the congress. Latest findings on nutrition research reported during the sessions showed the advances made and where more work is needed. Panel discussions and symposia were devoted to practical aspects of meeting human needs in all parts of the world.

Underlying most of the discussions was concern for the undernutrition that exists in half the world, overconsumption of food in the other, and the threat inherent in the continuing population explosion. Secretary of Agriculture Ezra T. Benson called for more research "to give us new insight into the relation of food to health so that we may employ our food resources ever more wisely."

President Eisenhower and Secretary Benson outlined the contributions the United States is making to world food supplies through the Food for Peace program. In this, individual nations, United Nations agencies, and private agencies are distributing donated food to areas needing it.

B. R. Sen, director-general of the United Nations Food and Agriculture Organization, described the Freedom From Hunger Campaign to raise agricultural productivity in underdeveloped countries through research, education, and action programs.

Red tick found in Florida

The red tick, *Rhipicephalus evertsi*, carrier of several foreign animal diseases such as East Coast fever, was found recently in Florida and New York.

This is the first time the species—common to Africa and also a carrier of cattle tick fever—has been identified in North America, according to ARS scientists.

Discovery of the tick poses a new difficulty in eradication because it can survive on the ground more than a year. This parasite can be carried by a second host animal after it has dropped from the first.

The African diseases carried by the tick are not known to be present in the U.S. The tick is also a potential vector of cattle tick fever, not now known to exist in this country, and possibly of several diseases that do exist here.

State-Federal livestock disease eradication officials first found the

red tick on zoo animals in a 160-acre wild-animal compound in the southeast corner of Palm Beach County near Boca Raton, Fla. Shortly after, the tick was found on 7 of 10 zebras in a private zoological garden near Tampa, Fla., and on 2 of 3 zebras at a game farm near Hudson, N.Y. These animals were part of a shipment of zebras that originated in Kenya, East Africa. The animals were enroute 28 days and underwent a 30-day quarantine in the U.S. before release to zoos.

USDA officials are cooperating with State animal health authorities and zoo personnel in New York and Florida to carry out preventive measures. These include placing the zoos under quarantine; insecticide treatment of animals, premises, and surrounding areas; and thorough inspection of other animals in the zoos and nearby areas.

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